

California High-Speed Train Project



TECHNICAL MEMORANDUM

Codes, Regulations, Design Standards and Guidelines TM 1.1.1

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System Level Technical and Integration Reviews

The purpose of the review is to ensure:

- Technical consistency and appropriateness
- Check for integration issues and conflicts

System level reviews are required for all technical memoranda. Technical Leads for each subsystem are responsible for completing the reviews in a timely manner and identifying appropriate senior staff to perform the review. Exemption to the System Level technical and integration review by any Subsystem must be approved by the Engineering Manager.

System Level Technical Reviews by Subsystem:

Systems:	<u>Signed document on file</u> Eric Scotson	<u>07 July 09</u> Date
Infrastructure:	<u>Signed document on file</u> John Chirco	<u>30 Jun 09</u> Date
Operations:	<u>Signed document on file</u> Paul Mosier	<u>04 July 09</u> Date
Maintenance:	<u>Signed document on file</u> Paul Mosier	<u>04 July 09</u> Date
Rolling Stock:	<u>Signed document on file</u> Frank Banko	<u>26 Jun 09</u> Date

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ABSTRACT

This technical memorandum identifies system-wide regulations, codes, and design standards to be incorporated, as applicable, into the design of the California High-Speed Train Project (CHSTP). It is intended to be used by designers to ensure that the preliminary design addresses applicable design requirements. Regional and local regulations, codes and standards are to be identified and incorporated as applicable by designers.

This technical memorandum serves as a basis for developing the CHSTP design manual and:

- Establishes a hierarchy for the application of design requirements
- Presents guidance for resolving conflicting design requirements
- References protocols to address design variance

Additional system-wide regulations, codes and design standards may be identified and incorporated as applicable as the CHSTP progresses to the 30% Design Level.

1.0 INTRODUCTION

1.1 PURPOSE OF TECHNICAL MEMORANDUM

This technical memorandum identifies the system-wide regulations, codes, standards and guidelines to be assessed and incorporated as applicable in the design of the California High-Speed Train Project (CHSTP). Applicable regulations, codes and design standards include international, federal, state, regional (county and city) as well as industry requirements. Furthermore, this technical memorandum addresses the resolution of potential conflicts among differing design requirements. Regional and local regulations, codes, standards, and guidelines are to be identified and incorporated as applicable by the designers. Additional system-wide requirements may be identified by the Authority.

1.2 STATEMENT OF TECHNICAL ISSUE

Requirements for the elements which make up CHSTP are broad in scope, geography and level of guidance. This document provides designers with a summary listing of system-wide codes, regulations and standards that are to be incorporated into the preliminary design of the high-speed train system as applicable. These include international, federal, state, and industry regulations, codes and standards. Applicable local and regional requirements shall be identified by the designer.

1.3 GENERAL INFORMATION

1.3.1 Definition of Terms

<u>Code</u>	A type of legislation that purports to exhaustively cover a complete system of law on a specific subject matter to define a procedure or performance requirement.
<u>Guideline</u>	Non-mandatory, recommended, and supplemental information regarding generally acceptable methods to satisfy provisions of a regulation, code, standard
<u>Practice</u>	A specific type of professional activity, such as the professional standard of care by an industry or widely accepted representative entity that contributes to the execution of a process by employing one or more techniques and tools.
<u>Regulation</u>	A rule and administrative code issued by governmental agencies at all levels – federal, state, county, and municipal that impose specific requirements and at times mandate permits or approvals by the agency (generally to ensure health and safety of the public). Although regulations are not laws, they have the force of law as they are adopted under authority granted by statutes.
<u>Standard</u>	Uniform criteria, methods, processes and practices developed by a regulatory body, agency, industry association, or organizations such as trade unions and trade associations, or other professional affiliations, that represent accepted requirement or a benchmark to measure against.
<u>Acronyms</u>	
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ADA	Americans with Disabilities Act
ADAAG	Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities
AISC	American Institute of Steel Construction
ANSI	American National Standards Institute
AREMA	American Railway Engineering and Maintenance-of-Way Association

ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
ATC	Applied Technology Council
Authority	California High-Speed Rail Authority
AWS	American Welding Society
BNSF	Burlington Northern Santa Fe Railway
BSI	British Standards Institute
CADD	Computer-aided Design and Drafting
CalDAG	California Disabled Accessibility Guidebook
Caltrain	Peninsula Corridor Joint Powers Board
Caltrans	California Department of Transportation
CBDA	Caltrans Bridge Design Aids Manual
CBDD	Caltrans Bridge Design Details Manual
CBDS	Caltrans Bridge Design Specifications
CBPD	Caltrans Bridge Design Practices Manual
CBSC	California Building Standards Code
CEN	European Committee for Standardization
CFR	Code of Federal Regulations
CHSTP	California High-Speed Train Project
CMTD	Caltrans Bridge Memorandum to Designers Manual
CPUC	California Public Utilities Commission
CRR	California Code of Regulations
CSDC	Caltrans Seismic Design Criteria
EN	European Norm, European Standard
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
IBC	International Building Code
IEEE	Institute of Electrical and Electronics Engineers
ISO	International Organization for Standardization
LFRD	Load and Resistance Factor Design
NEC	National Electric Code
NEHRP	National Earthquake Hazards Reduction Program
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
SCRRA	Southern California Regional Rail Authority
SIA	Swiss Standards for Construction
SNCF	French National Railway
TM	Technical Memorandum
TSI	Technical Specifications for Interoperability (concerning Trans-European High-Speed Rail)
UIC	International Union of Railways
UP	Union Pacific Rail Road
USACE	United States Army Corps of Engineers
USDOT	United States Department of Transportation
USGS	United States Geological Survey

1.3.2 Units

The California High-Speed Train Project is based on U.S. Customary Units consistent with guidelines prepared by the California Department of Transportation and defined by the National Institute of Standards and Technology (NIST). U.S. Customary Units are officially used in the United States, and are also known in the U.S. as “English” or “Imperial” units. In order to avoid any confusion, all formal references to units of measure should be made in terms of U.S. Customary Units.

Guidance for units of measure terminology, values, and conversions can be found in the Caltrans Metric Program Transitional Plan, Appendice B U.S. Customary General Primer (<http://www.dot.ca.gov/hq/oppd/metric/TransitionPlan/Appendice-B-US-Customary-General-Primer.pdf>). Caltrans Metric Program Transitional Plan, Appendice B can also be found as an attachment to the CHSTP Mapping and Survey Technical Memorandum.

2.0 DEFINITION OF TECHNICAL TOPIC

2.1 GENERAL

This document identifies the system-wide regulations, codes, and standards that are to be incorporated as applicable into the design of the high-speed train system. Identification and application of regional and local requirements are the responsibility of the designer.

2.1.1 CHSTP Design Considerations

CHSTP policy considerations are identified in TM 0.3 - Basis of Design Policy Document.

2.2 LAWS AND CODES

Design criteria for the CHSTP are under development. When completed, a CHSTP Design Manual will present standards and guidelines specifically for the design and construction of the California high-speed train system. Initial CHSTP design criteria will be issued in technical memoranda that provide guidance and procedures to advance the design of project-specific elements. Criteria for design elements not specific to high-speed train operations will be governed by existing applicable standards, laws, and codes, as defined in this document.

2.3 APPLICABILITY TO FEDERAL REGULATIONS

To follow.

2.4 POLICY CONSIDERATIONS

2.4.1 International Codes, Regulations and Standards

International codes, regulations, and standards are the basis for much of the high-speed system requirements and design guidance and are appropriate for use in advancing the preliminary design. It is not anticipated that these international requirements will be binding for the CHSTP unless specifically adopted by the Authority.

It may be necessary for the Authority to adopt certain international standards for the CHSTP if there is no alternate, applicable US source information pertaining to high-speed train design that is currently available for use as a project standard.

3.0 ASSESSMENT / ANALYSIS

3.1 GENERAL

CHSTP design criteria are generally intended for the design of high-speed train system elements. Design of elements not specific to high-speed train design may be governed by applicable existing laws, codes, and standards. This document presents existing regulations, codes, standards and guidelines that are to be incorporated into the design of the high-speed train project, as applicable. Regulations, codes, and standards include international, federal, state, and industry regulations, codes and standards. The regulations, codes, and standards presented herein will serve as a regulatory requirements and guidance for the project and will be included in the CHSTP Design Manual. Regional and local requirements are to be identified and incorporated as applicable by the designer. Any additional system-wide codes, regulations, standards and guidelines will be provided by the Authority.

Codes, regulations, standards and guidelines each provide a different level of mandate and guidance. A code is a type of legislation that exhaustively covers a complete system of law on a specific subject matter to define a procedure or performance requirement. Regulations are rule and administrative code issued by governmental agencies that impose specific requirements and at times mandate permits or approvals by the agency (generally to ensure health and safety of the public). Although regulations are not laws, they have the force of law as they are adopted under authority granted by statutes. Standards are uniform criteria, methods, processes and practices developed by a regulatory body, agency, industry association, or organizations such as trade unions and trade associations, or other professional affiliations, that represent accepted requirement or a benchmark to measure against. Guidelines are non-mandatory, recommended, and supplemental information regarding generally acceptable methods to satisfy provisions of a regulation, code, or standard. Generally, codes and regulations are legally mandated within applicable jurisdictions. Standards and guidelines provide guidance and may be required by an agency but are not legally mandated. Standards may additionally be required for regulatory approvals.

3.2 ASSESSMENT

Regulations, codes, standards, and regional ordinances and references exist on the international, federal, state, and regional levels that are applicable for the design and construction of the high-speed train project. In general, applicable regulations and codes take precedence over design standards.

3.2.1 Regulations and Codes

Existing federal and state regulations and codes govern passenger and freight rail systems in the United States. These regulations are typically applicable to the basis of design and govern the operation of conventional rail networks; these do not specifically address the basis of design or govern the operation of high-speed train systems operating at speeds over 150 mph. As such, international regulations and codes provide additional guidance. Other regulations and codes apply to the design of buildings and facilities and are not specific to the design of the CHST system.

Regulations and codes to be incorporated into CHSTP design, where appropriate, are presented in the following sections.

3.2.1.1 International

- Technical Specifications for Interoperability (TSI) concerning Trans-European High-Speed Rail
- European Standards (EN for European Norms)
 - European Committee for Standardization (CEN)
 - European Committee for Electrotechnical Standardization (CENELEC)
 - European Telecommunications Standard Institute (ETSI)

- Ministerial Ordinance for provide the technical standard about railway ((Shinkansen) [Tentative]
- International Building Code (IBC)
- International Union of Railways (UIC) Code
- Uniform Building Code (UBC)

3.2.1.2 Federal

- Americans with Disabilities Act (ADA)
- Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)
- Code of Federal Regulations (CFR), specifically 49 CFR Parts 200-299
- U.S. Environmental Protection Agency (EPA) Laws, Regulations, Guidance and Dockets, and Executive Orders
- National Electric Code (NEC)
- National Electrical Safety Code (NESC)
- National Fire Protection Association (NFPA) Codes and Standards

3.2.1.3 State

- California Building Standards Code (CBSC), Title 24 of CCR
- California Business and Professions Code
- California Code of Regulations (CRR)
- California Public Utilities Commission (CPUC) General Orders (GO)

3.2.2 Standards

Standards have been developed by governments, industries, and operators for design and construction to ensure consistency and compatibility among various elements of a rail system. In some cases, fulfilment of standards may be required to secure regulatory approvals from the Army Corps of Engineers, Division of the State Architect, Office of the State Fire Marshall, California Coastal Commission, Caltrans, and other agencies and authorities. The following are applicable standards:

3.2.2.1 International

- British Standards Institute (BSI) Standards
- International Organization for Standardization (ISO)
- RFI (Italian Railway Network) Standards
- SIA (Swiss Building Code) Standards
- SNCF (French National Railway) Design Standards
- The Interpretive Criteria (Shinkansen) [Tentative]

3.2.2.2 Federal

- American National Standards Institute (ANSI)
- Federal Emergency Management Agency (FEMA) Guidelines
- Federal Highway Administration (FHWA) Guidelines
- National Earthquake Hazards Reduction Program (NEHRP)
- US Army Corps of Engineers Guidelines
- US Bureau of Land Management Surveying Manual
- United States Geological Survey (USGS) Standards

3.2.2.3 State

- California Disabled Accessibility Guidebook (CalDAG)

- Caltrans Bridge Design Manuals, including Bridge Design Specification (CBDS), Bridge Design Practices Manual (CBPD), Bridge Design Aids Manual (CBDA), Bridge Design Details Manual (CBDD), Bridge Memo to Designers Manual (CMTD), Standard Specifications, Standard Plans, Seismic Design Memorandum, Caltrans Seismic Design Criteria ver. 1.4 (CSDC)
- Caltrans CADD Standards and Users Manual
- Caltrans Highway Design Manual
- Caltrans Plans Preparation Manual and other guidelines for report preparation
- Caltrans Project Development Procedures Manual
- Caltrans Standard Plans and Specifications
- Caltrans Surveys Manual
- Caltrans Transportation Management Planning Guidelines
- Caltrans User's Guide to Photogrammetric Products and Services
- Caltrans Right of Way Manual, and Forms and Exhibits
- Other Right of Way Publications

3.2.2.4 Industry

- American Association of State Highway and Transportation Officials (AASHTO) Guidance
- American Concrete Institute (ACI) Building Code Requirements
- American Institute of Steel Construction (AISC) Steel Construction Manual
- American Public Transit Association (APTA) Guidance
- American Railway Engineering and Maintenance of Way Association (AREMA) Manual and Portfolio of Trackwork Plans
- American Society for Photogrammetry and Remote Sensing (ASPRS) Manual
- American Society for Testing and Materials (ASTM) Standards
- American Society of Civil Engineers (ASCE) Guidelines
- American Welding Society (AWS) Codes
- Amtrak Standards and Guidelines
- Burlington Northern Santa Fe (BNSF) Railway Engineering Standards
- Institute of Electrical and Electronics Engineers (IEEE) Standards
- Peninsula Corridor Joint Powers Board (Caltrain) Design Criteria and Engineering Standards
- Southern California Regional Rail Authority (SCRRA) Engineering Standards
- Union Pacific (UPRR) Railroad Engineering Standards

3.2.3 Regional Ordinances and Governance Bodies

State projects are not subject specifically to regional and local codes. Because the Authority is an agency of the state government, development of facilities within the state's right-of-way shall fall under the jurisdiction of the Division of the State Architect (DSA) and the State Fire Marshall along with input and coordination with local jurisdictions. As regional ordinances and governance bodies are geography-based, guidance will not be applicable along all segments of the CHST system. However, the high-speed train system will connect and integrate with other passenger rail and transit services and will communities and high-speed train stations. As such, consideration of regional and local codes, standards and requirements is necessary. It is the obligation of the Designer to identify regional ordinances and government bodies applicable to sections they are designing.

3.2.3.1 Local Jurisdiction

Regulations, codes, and standards of local governing bodies shall be considered along with site specific permit and operational requirements. The following are representative local agencies, organizations and services that may have specific design standards and specifications, operational and facility requirement that should be considered in the design of CHSTP facilities.

- Air Quality Districts
- Bicycle Coalitions
- City, County, Municipal, Codes and Ordinances
- City, County, Municipal Utilities Codes and Standards
- Congestion Management Agencies
- County Transportation Authorities
- Departments of Public Works
- Fire Departments
- Freight Railroads
- Local Flood Control Districts
- Local Transit Agencies
- Passenger Rail Agencies
- Parks and Recreation Departments
- Public Utilities Commission(s)
- Regional Comprehensive Planning Agencies
- Regional Council of Governments
- Regional Environment Agencies and Commissions
- Regional Water Quality Control Boards
- School Districts
- Waste Management entities

Applicable ordinances of counties, cities and unincorporated jurisdictions where CHSTP facilities are located shall be included in the design as determined by the designer.

3.3 DESIGN REQUIREMENTS BY SUBSYSTEM

Initial CHSTP design criteria will be issued in technical memoranda that provide guidance and procedures for use in advancing the preliminary engineering of the high-speed train facilities. Supplementary guidance for the design of CHSTP facilities are defined in numerous codes, regulations, standards and guidelines. Codes, regulations, design standards and guidelines to be incorporated into CHSTP design as applicable are summarized in Table 3-1. Note that many of the listed documents include additional material for incorporation by reference.

Table 3-1 – Codes, Regulations, Design Standards and Guidelines to Incorporate into Design as Applicable

Sub-Systems	Codes and Regulations	Standards and Guidelines
General	<ul style="list-style-type: none"> Code of Federal Regulations (CFR) 49 Parts 200-299 State of California Board for Professional Engineers and Land Surveyors, Land Surveyors Act (Business & Professional Code 8700-8805) U.S. Environmental Protection Agency (EPA) Laws, Regulations, Guidance and Dockets, and Executive Orders 	<ul style="list-style-type: none"> Manual for Railway Engineering of the American Railway Engineering and Maintenance-of-Way Association (AREMA Manual) Caltrans Highway Design Manual, Chapter 80: Application of Design Standards Caltrans Project Development Procedures Manual
INFRASTRUCTURE		
Alignment (Plan and Profile)	<ul style="list-style-type: none"> Technical Specifications for Interoperability for the Trans-European High-Speed Rail System (TSI) CFR49 Part 213, Track Safety Standards, generally and also in particular Subpart G –Train Operations at Track Classes 6 and Higher. CFR49 Part 214, Railroad Workplace Safety. California Public Utilities Commission (CPUC) General Order (GO) 26: Clearances On Railroads And Street Railroads As To Side And Overhead Structures, Parallel Tracks And Crossings CPUC GO 95: Overhead Electric Line Construction. Generally and also see in particular Section VII, Detailed Construction Requirements for Trolley and Electric Railway Contact and Feeder Conductors and Their Supporting Messengers, Span Wires, Etc. (Class T Circuits) CPUC GO 118: Regulations Governing the Construction, Reconstruction, and Maintenance of Walkways Adjacent to Railroad Trackage and the Control of Vegetation Adjacent Thereto CPUC GO 164: Rules And Regulations Governing State Safety Oversight Of Rail Fixed Guideway Systems UIC (International Union of Railways) Code 703 – Layout Characteristics of Lines Used by Fast Passenger Trains 	<ul style="list-style-type: none"> Caltrans Manuals and Standards, including Highway Design Manual and Section VII, Detailed Construction Requirements for Trolley and Electric Railway Contact and Feeder Conductors and Their Supporting Messengers, Span Wires, Etc. (Class T Circuits) AREMA Manual, in particular Chapter 1: Roadway and Ballast , Chapter 5: Track, Chapter 17: High Speed Rail Systems, Chapter 28: Clearances ,Chapter 33: Electrical Energy Utilization Comité Européen de Normalisation – European Committee for Standardization (CEN standard) UIC – Design of new lines for speeds of 300 – 350 km/h Caltrans Surveys Manual Caltrans User's Guide to Photogrammetric Products and Services United States Bureau of Land Management's Manual of Surveying Instructions United States Geological Survey (USGS) National Map Accuracy Standards Manual of Photogrammetry, American Society of Photogrammetry and Remote Sensing Caltrans Plans Preparation Manual, including Caltrans CADD Standards, Caltrans Surveys Manual (Chapter 4, Survey Datums) Caltrans EZ Guide, CADD Users Manual Burlington Northern Santa Fe (BNSF) Railway Engineering Standards Union Pacific (UP) Railroad Engineering Standards Southern California Regional Rail Authority (SCRRA) Engineering Standards Peninsula Corridor Joint Powers Board (Caltrain) Design Criteria and Engineering Standards
Temporary Construction Facilities	<ul style="list-style-type: none"> Applicable codes and regulations to be defined 	<ul style="list-style-type: none"> Applicable standards and guidelines to be defined

Sub-Systems	Codes and Regulations	Standards and Guidelines
Stations	<ul style="list-style-type: none"> • 49 CFR Part 213, Track Safety Standards • 49 CFR Parts 27, 37 and 38, Transportation for Individuals with Disabilities • California Public Utilities Commission (PUC) General Orders (GO), including: <ul style="list-style-type: none"> • GO 26: Clearances On Railroads And Street Railroads As To Side And Overhead Structures, Parallel Tracks And Crossings • GO 164: Rules And Regulations Governing State Safety Oversight Of Rail Fixed Guideway Systems • Technical Specifications for Interoperability for the Trans-European High-Speed Rail System (TSI) • Americans with Disabilities Act (ADA) • ADA Guidelines for Buildings and Facilities (ADAAG) • National Fire Protection Association (NFPA) 130: Standard for Fixed Guideway Transit and Passenger Rail Systems • NFPA 101: Life Safety Code • International Building Code (IBC) • Uniform Building Code (UBC) • California Code of Regulations (CCR), Title 24, California Building Standards Code 	<ul style="list-style-type: none"> • American National Standards Institute (ANSI) 117.1 – standard for accessible design for persons with disabilities • SCRRRA Engineering Standards • Caltrain Design Criteria and Engineering Standards • Amtrak Station Program & Planning Standards and Guidelines • California Disabled Accessibility Guidebook (CalDAG) • AREMA Manual, in particular Chapter 4: Rail, Chapter 5: Track, and Portfolio of Trackwork Plans • UP Railroad Engineering Standards • BNSF Railway Engineering Standards

Sub-Systems	Codes and Regulations	Standards and Guidelines
Bridges and Elevated Structures	<ul style="list-style-type: none"> • 49 CFR Part 213, Appendix C - Statement of Agency Policy on the Safety of Railroad Bridges • NFPA Codes and Standards including 130 - Standard for Fixed Guideway Transit and Passenger Rail Systems • California Code of Regulations (CCR) Title 24, California Building Standards Code • American Concrete Institute (ACI) 318, Building Code Requirements for Reinforced Concrete • American Welding Society (AWS), Structural Welding Code, Steel, 1996 ANSI/AWS D1.1-96 and Bridge Welding Code ANSI/AASHTO/AWSD1.5-95 	<ul style="list-style-type: none"> • European Standard EN 1990 annexe A2: Application to Bridges Federal Railroad Administration (FRA) requirements for containment of high-speed trains on aerial structures • AREMA Manual • American Institute of Steel Construction (AISC), Steel Construction Manual • American Association of State Highway and Transportation Officials (AASHTO) Load and Resistance Factor Design (LRFD) Bridge Design Specifications, 2007, with California Amendments • Caltrans Bridge Design Manuals, including: Bridge Design Specification (CBDS), Bridge Design Practices Manual (CBPD), Bridge Design Aids Manual (CBDA), Bridge Design Details Manual (CBDD), Bridge Memo to Designers Manual (CMTD), Standard Specifications, Standard Plans, Seismic Design Memorandum, Caltrans Seismic Design Criteria ver. 1.4 (CSDC)) • European Standard EN 1991-2:2003 Traffic Loads on Bridges • European Standard EN 1990 Annex A2: Application to Bridges • Federal Emergency Management Agency (FEMA) 356 - Prestandard and Commentary for the Seismic Rehabilitation of Buildings • National Earthquake Hazards Reduction Program (NEHRP) – Recommended Provisions for Seismic Regulations for New Buildings and Other Structures • Federal Highway Administration (FHWA) Seismic Retrofitting Manual for Highway Structures: Part 1-Bridges and Part 2-Retaining Structures, Slopes, Tunnels, Culverts, and Roadways • Applied Technology Council (ATC) 32 – Improved Seismic Design Criteria for California Bridges: Provisional Recommendations

Sub-Systems	Codes and Regulations	Standards and Guidelines
Tunnels	<ul style="list-style-type: none"> California Public Utilities Commission (CPUC) General Order (GO) 26: Clearances On Railroads And Street Railroads As To Side And Overhead Structures, Parallel Tracks And Crossings CPUC GO 95: Overhead Electric Line Construction. Generally and also see in particular Section VII, Detailed Construction Requirements for Trolley and Electric Railway Contact and Feeder Conductors and Their Supporting Messengers, Span Wires, Etc. (Class T Circuits) CPUC GO 118: Regulations Governing the Construction, Reconstruction, and Maintenance of Walkways Adjacent to Railroad Trackage and the Control of Vegetation Adjacent Thereto NFPA 130, Standard for Fixed Guideway Transit and Passenger Rail Systems Swiss code SIA 197/1:2004, "Projets de tunnels – Tunnel ferroviaires" Technical Specification for Interoperability (TSI) relating to 'safety in railway tunnels' in the trans-European conventional and high-speed rail system International Union of Railways (UIC) Code 779-11-R and 779-9-R American Concrete Institute (ACI) 318, Building Code Requirements for Reinforced Concrete American Welding Society (AWS): Structural Welding Code, Steel, 1996 ANSI/AWS D1.1-96 and Bridge Welding Code ANSI/AASHTO/AWS D1.5-95 California Code of Regulations (CCR) Title 24, California Building Standards Code 	<ul style="list-style-type: none"> Rete Ferroviaria Italiana (RFI, Italian railway network) Design Handbook, Safety Standards for New Railway Tunnels Comité Européen de Normalisation (CEN), European Committee for Standardization Standard UIC – Design of new lines for speeds of 300 – 350 km/h Société Nationale des Chemins de fer français (SNCF, French National Railway) – High-speed railway design standards (2007 edition) AREMA Manual, in particular Chapter 17: High Speed Rail Systems and Chapter 28: Clearances BNSF Railway Engineering Standards UP Railroad Engineering Standards Southern California Regional Rail Authority (SCRRA) Engineering Standards Caltrain Design Criteria and Engineering Standards Amtrak Design Criteria American Institute of Steel Construction (AISC), Steel Construction Manual American Association of State Highway and Transportation Officials (AASHTO) Load and Resistance Factor Design (LRFD) Bridge Design Specifications, 2007, with California Amendments Caltrans Bridge Design Manuals, including: Bridge Design Specification (CBDS), Bridge Design Practices Manual (CBPD), Bridge Design Aids Manual (CBDA), Bridge Design Details Manual (CBDD), Bridge Memo to Designers Manual (CMTD), Standard Specifications, Standard Plans, Seismic Design Memorandum, Caltrans Seismic Design Criteria ver. 1.4 (CSDC)) European Standard EN 1991-2:2003 Traffic Loads on Bridges European Standard EN 1990 Annex A2: Application to Bridges Federal Emergency Management Agency (FEMA) 356 - Prestandard and Commentary for the Seismic Rehabilitation of Buildings National Earthquake Hazards Reduction Program (NEHRP) – Recommended Provisions for Seismic Regulations for New Buildings and Other Structures Federal Highway Administration (FHWA) Seismic Retrofitting Manual for Highway Structures: Part 1-Bridges and Part 2-Retaining Structures, Slopes, Tunnels, Culverts, and Roadways Applied Technology Council (ATC) 32 – Improved Seismic Design Criteria for California Bridges: Provisional Recommendations

Sub-Systems	Codes and Regulations	Standards and Guidelines
Buildings	<ul style="list-style-type: none"> Americans with Disabilities Act (ADA) ADA Guidelines for Buildings and Facilities (ADAAG) National Fire Protection Association (NFPA) 130 California Code of Regulations (CCR) Title 24, California Building Standards Code California Public Utility Commission (CPUC) General Orders (GO) International Building Code (IBC) Uniform Building Code (UBC) American Concrete Institute (ACI) 318, Building Code Requirements for Reinforced Concrete American Welding Society (AWS) Structural Welding Code, Steel, 1996 ANSI/AWS D1.1-96 and Bridge Welding Code ANSI/AASHTO/AWS D1.5-95 	<ul style="list-style-type: none"> California Disabled Accessibility Guidebook (CalDAG) American Association of State Highway and Transportation Officials (AASHTO) Load and Resistance Factor Design (LRFD) Bridge Design Specifications, 2007, with California Amendments AREMA Manual American Institute of Steel Construction (AISC), Steel Construction Manual Caltrans Bridge Design Manuals, including: Bridge Design Specification (CBDS), Bridge Design Practices Manual (CBPD), Bridge Design Aids Manual (CBDA), Bridge Design Details Manual (CBDD), Bridge Memo to Designers Manual (CMTD), Standard Specifications, Standard Plans, Seismic Design Memorandum, Caltrans Seismic Design Criteria ver. 1.4 (CSDC)) European Standard EN 1991-2:2003 Traffic Loads on Bridges European Standard EN 1990 Annex A2: Application to Bridges Federal Emergency Management Agency (FEMA) 356 - Prestandard and Commentary for the Seismic Rehabilitation of Buildings National Earthquake Hazards Reduction Program (NEHRP) – Recommended Provisions for Seismic Regulations for New Buildings and Other Structures Federal Highway Administration (FHWA) Seismic Retrofitting Manual for Highway Structures: Part 1-Bridges and Part 2-Retaining Structures, Slopes, Tunnels, Culverts, and Roadways Applied Technology Council (ATC) 32 – Improved Seismic Design Criteria for California Bridges: Provisional Recommendations
Grading	<ul style="list-style-type: none"> International Union of Railways (UIC) Code 719 R “Earthworks and Track-bed Layers for Railway Lines” 	<ul style="list-style-type: none"> AREMA Manual Caltrans Highway Design Manual Caltrans Standard Specification International Organization for Standardization (ISO) Comité Européen de Normalisation (CEN. European Standards Committee) U.S. Army Corp of Engineers Technical and Design Guides American Society for Testing and Materials (ASTM) Standards British Standards Institute (BSI) Standards Union Internationale des Chemins de fer (UIC, International Union of Railways)
Hydrology/Hydraulics / Drainage	<ul style="list-style-type: none"> Applicable codes and regulations to be defined 	<ul style="list-style-type: none"> Applicable standards and guidelines to be defined
Utilities	<ul style="list-style-type: none"> CPUC General Orders 	<ul style="list-style-type: none"> Caltrans Highway Design Manual Caltrans Project Development Procedures Manual AREMA Manual

Sub-Systems	Codes and Regulations	Standards and Guidelines
Geotechnical	<ul style="list-style-type: none"> Applicable codes and regulations to be defined 	<ul style="list-style-type: none"> American Society for Testing and Materials (ASTM) Standards per FHWA, Caltrans, and AREMA American Society of Civil Engineers (ASCE), "Geotechnical Baseline Reports for Construction – Suggested Guidelines" FHWA Checklist and Guidelines for Review of Geotechnical Reports and Preliminary Plans and Specifications Caltrans Guidelines for Preparing Geotechnical Design Reports Caltrans Guidelines for Structures Foundations Reports
Right of Way	<ul style="list-style-type: none"> Applicable codes and regulations to be defined 	<ul style="list-style-type: none"> Applicable standards and guidelines to be defined
Construction Cost Estimate	<ul style="list-style-type: none"> Applicable codes and regulations to be defined 	<ul style="list-style-type: none"> Federal Transit Agency - Standard Cost Categories International Association for the Advancement of Cost Engineering (AACE) - Recommended Practice No. 10S-90 – Cost Engineering Terminology
SYSTEMS		
Traction Power	<ul style="list-style-type: none"> CPUC General Orders (GO) including GO95: Overhead electric line construction will require Amendments to cover 2 x 25 kV (or 25kV) National Electrical Code (NEC) National Electrical Safety Code (NESC) NFPA Codes and Standards 	<ul style="list-style-type: none"> AREMA Manual Institute of Electrical and Electronics Engineers (IEEE) 80: Safety in Substation Grounding and other applicable standards
PUC/Electric Power Connections	<ul style="list-style-type: none"> CPUC General Orders (GO) including GO95: Overhead electric line construction will require Amendments to cover 2 x 25 kV (or 25kV) National Electrical Code (NEC) National Electrical Safety Code (NESC) NFPA Codes and Standards 	<ul style="list-style-type: none"> AREMA Manual Institute of Electrical and Electronics Engineers (IEEE) 80: Safety in Substation Grounding and other applicable standards
Overhead Contact System (OCS)	<ul style="list-style-type: none"> Technical Specifications for Interoperability for the Trans-European High-Speed Rail System (TSI) CPUC General Orders (GO) including GO95: Overhead electric line construction will require Amendments to cover 2 x 25 kV (or 25kV) GO26-D: Clearances on railroads and street railroads as to side and overhead structures, parallel tracks and crossings 	<ul style="list-style-type: none"> AREMA Manual Amtrak Design Guidelines Caltrain Design Criteria and Engineering Standards
Communications	<ul style="list-style-type: none"> Applicable codes and regulations to be defined 	<ul style="list-style-type: none"> Applicable standards and guidelines to be defined
Trackside Services	<ul style="list-style-type: none"> Applicable codes and regulations to be defined 	<ul style="list-style-type: none"> Applicable standards and guidelines to be defined

3.4 REQUIREMENT PRECEDENCE AND RESOLUTION OF CONFLICTS

3.4.1 Precedence by Jurisdiction

CHSTP design criteria and standards shall supersede industry standards as they pertain to high-speed train system elements. CHSTP design standards and guidelines may differ from federal and state codes and standards. Regional and local guidance are to be considered but are not mandated. In the case of differing values, the standard followed shall be that which results in the satisfaction of all applicable requirements. Where high-speed trains operate within another railroad or transportation operator's corridor, the requirements of the CHSTP and the owner/operator's standards shall be met.

3.4.2 Precedence by Type of Requirement

In general, applicable regulations and codes take precedence over standards. In the case of differing values between the governing regulations, codes, and standards, the criterion followed shall be that which results in the satisfaction of all applicable requirements. Standards shall be mandated as required for securing regulatory approval.

3.4.3 Resolution of Conflicting Requirements

In the case of conflicts, documentation of the conflicting requirements is to be prepared. The designer shall submit their recommendation for a new design criteria or adoption of one of the conflicting regulations or standards for approval to the Authority. In the case of differing values, conflicts in the various requirements for design, or discrepancies in application of the design standards, the criteria followed shall be that which results in the highest level of satisfaction for all requirements or that is deemed as the most appropriate by the California High-Speed Rail Authority (Authority). The designer shall meet this goal by assessing the appropriate industry standards and proposing project-specific design criteria or use of existing standards in order to meet project objectives and satisfy regulatory requirements.

In cases where the conflict can not be resolved through the use of the common standard or a new project specific design criteria, the Authority shall work with the designer to establish a solution. This may be achieved by preparing a variance request for the conflicting design criteria and securing an approval from the governing regulatory agency. In some cases, this will lead to new regulations, codes, or industry standards.

3.5 PROTOCOLS FOR DESIGN VARIANCE AND EXCEPTION APPROVALS

Variances, or exceptions, to applicable federal and state codes and regulations and design standards require written approval by the agency or authority having jurisdiction or both.

Technical Memorandum TM 1.1.18 - Design Variance Guidelines defines the procedure for identifying, preparing, requesting, and documenting a design variance from CHSTP Standard Drawings, Standard Specifications, and Minimum Design Criteria as well as other adopted standards or design guidelines.

Application for variance requests, including the preparation of required supporting documentation, is the responsibility of the designer, unless otherwise directed by the Authority.

4.0 SUMMARY AND RECOMMENDATIONS

The regulations, codes, standards, regional and local ordinances to be considered in the design of the CHSTP are presented in Section 6.0.

5.0 SOURCE INFORMATION AND REFERENCES

1. California High-Speed Train Project Technical Memoranda (through June 2009).

6.0 DESIGN MANUAL CRITERIA

6.1 CODES, REGULATIONS, DESIGN STANDARDS AND GUIDELINES

CHSTP design criteria are generally intended for the design of high-speed train system elements. Design of elements not specific to high-speed train design may be governed by applicable existing laws, codes, and standards. This document presents existing regulations, codes, standards and guidelines that are to be incorporated into the design of the high-speed train project, as applicable. Regulations, codes, and standards include international, federal, state, and industry regulations, codes and standards. The regulations, codes, and standards presented herein will serve as a regulatory requirements and guidance for the project and will be included in the CHSTP Design Manual. Regional and local requirements are to be identified and incorporated as applicable by the designer. Any additional system-wide codes, regulations, standards and guidelines will be provided by the Authority.

Codes, regulations, standards and guidelines each provide a different level of mandate and guidance. A code is a type of legislation that covers a system of law on a specific subject matter to define a procedure or performance requirement. Regulations are rule and administrative code issued by governmental agencies that impose specific requirements and at times mandate permits or approvals by the agency (generally to ensure health and safety of the public). Although regulations are not laws, they have the force of law as they are adopted under authority granted by statutes. Standards are uniform criteria, methods, processes and practices developed by a regulatory body, agency, industry association, or organizations such as trade unions and trade associations, or other professional affiliations, that represent accepted requirement or a benchmark to measure against. Guidelines are non-mandatory, recommended, and supplemental information regarding generally acceptable methods to satisfy provisions of a regulation, code, or standard. Generally, codes and regulations are legally mandated within applicable jurisdictions. Standards and guidelines provide guidance and may be required by an agency but are not legally mandated. Standards may additionally be required for regulatory approvals.

6.1.1 Regulations and Codes

Existing federal and state regulations and codes govern passenger and freight rail systems in the United States. These regulations are typically for the basis of design and govern the operation of conventional rail networks and are not specifically applicable to the basis of design nor do they govern the operation of high-speed train systems with speeds over 150 mph. As such, international regulations and codes provide additional guidance. Other regulations and codes apply to the design of CHSTP buildings and facilities and are not specific to design of the CHST system.

Regulations and codes to be incorporated into CHSTP design, where appropriate, are presented in the following sections.

6.1.1.1 International

- Technical Specifications for Interoperability (TSI) concerning Trans-European High-Speed Rail
- European Standards (EN for European Norms)
 - European Committee for Standardization (CEN)
 - European Committee for Electrotechnical Standardization (CENELEC)
 - European Telecommunications Standard Institute (ETSI)
- Ministerial Ordinance for provide the technical standard about railway ((Shinkansen) [Tentative])
- International Building Code (IBC)
- International Union of Railways (UIC) Code
- Uniform Building Code (UBC)

6.1.1.2 Federal

- Americans with Disabilities Act (ADA)
- Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)
- Code of Federal Regulations (CFR), specifically 49 CFR Parts 200-299
- U.S. Environmental Protection Agency (EPA) Laws, Regulations, Guidance and Dockets, and Executive Orders
- National Electric Code (NEC)
- National Electrical Safety Code (NESC)
- National Fire Protection Association (NFPA) Codes and Standards

6.1.1.3 State

- California Building Standards Code (CBSC), Title 24 of CCR
- California Business and Professions Code
- California Code of Regulations (CRR)
- California Public Utilities Commission (CPUC) General Orders (GO)

6.1.2 Standards

Standards have been developed by governments, industries, and operators for design and construction to ensure consistency and compatibility among various elements of a rail system. In some cases, fulfillment of standards may be required to secure regulatory approvals from the Army Corps of Engineers, Division of the State Architect, Office of the State Fire Marshall, California Coastal Commission, Caltrans, and other agencies and authorities. The following are applicable standards:

6.1.2.1 International

- British Standards Institute (BSI) Standards
- International Organization for Standardization (ISO)
- RFI (Italian Railway Network) Standards
- SIA (Swiss Building Code) Standards
- SNCF (French National Railway) Design Standards
- The Interpretive Criteria (Shinkansen) [Tentative]

6.1.2.2 Federal

- American National Standards Institute (ANSI)
- Federal Emergency Management Agency (FEMA) Guidelines
- Federal Highway Administration (FHWA) Guidelines
- National Earthquake Hazards Reduction Program (NEHRP)
- US Army Corps of Engineers Guidelines
- US Bureau of Land Management Surveying Manual
- United States Geological Survey (USGS) Standards

6.1.2.3 State

- California Disabled Accessibility Guidebook (CalDAG)
- Caltrans Bridge Design Manuals, including Bridge Design Specification (CBDS), Bridge Design Practices Manual (CBPD), Bridge Design Aids Manual (CBDA), Bridge Design Details Manual (CBDD), Bridge Memo to Designers Manual (CMTD), Standard Specifications, Standard Plans, Seismic Design Memorandum, Caltrans Seismic Design Criteria ver. 1.4 (CSDC))
- Caltrans CADD Standards and Users Manual

- Caltrans Highway Design Manual
- Caltrans Plans Preparation Manual and other guidelines for report preparation
- Caltrans Project Development Procedures Manual
- Caltrans Standard Plans and Specifications
- Caltrans Surveys Manual
- Caltrans Transportation Management Planning Guidelines
- Caltrans User's Guide to Photogrammetric Products and Services
- Caltrans Right of Way Manual, and Forms and Exhibits
- Other Right of Way Publications

6.1.2.4 Industry

- American Association of State Highway and Transportation Officials (AASHTO) Guidance
- American Concrete Institute (ACI) Building Code Requirements
- American Institute of Steel Construction (AISC) Steel Construction Manual
- American Public Transit Association (APTA) Guidance
- American Railway Engineering and Maintenance of Way Association (AREMA) Manual and Portfolio of Trackwork Plans
- American Society for Photogrammetry and Remote Sensing (ASPRS) Manual
- American Society for Testing and Materials (ASTM) Standards
- American Society of Civil Engineers (ASCE) Guidelines
- American Welding Society (AWS) Codes
- Amtrak Standards and Guidelines
- Burlington Northern Santa Fe (BNSF) Railway Engineering Standards
- Institute of Electrical and Electronics Engineers (IEEE) Standards
- Peninsula Corridor Joint Powers Board (Caltrain) Design Criteria and Engineering Standards
- Southern California Regional Rail Authority (SCRRA) Engineering Standards
- Union Pacific (UP) Railroad Engineering Standards

6.1.3 Regional Ordinances and Governance Bodies

State projects are not subject specifically to regional and local codes. Because the Authority is an agency of the state government, development of facilities within the state's right-of-way shall fall under the jurisdiction of the Division of the State Architect (DSA) and the State Fire Marshall along with input and coordination with local jurisdictions. As regional ordinances and governance bodies are geography-based, guidance will not be applicable along all segments of the CHST system. However, the high-speed train system will connect and integrate with other passenger rail and transit services and will communities and high-speed train stations. As such, consideration of regional and local codes, standards and requirements is necessary. It is the obligation of the Designer to identify regional ordinances and government bodies applicable to sections they are designing.

6.1.3.1 Local Jurisdiction

Regulations, codes, and standards of local governing bodies shall be considered along with site specific permit and operational requirements. The following are representative local agencies, organizations and services that may have specific design standards and specifications, operational and facility requirement that should be considered in the design of CHSTP facilities.

- Air Quality Districts
- Bicycle Coalitions
- City, County, Municipal, Codes and Ordinances

- City, County, Municipal Utilities Codes and Standards
- Congestion Management Agencies
- County Transportation Authorities
- Departments of Public Works
- Fire Departments
- Freight Railroads
- Local Flood Control Districts
- Local Transit Agencies
- Passenger Rail Agencies
- Parks and Recreation Departments
- Public Utilities Commission(s)
- Regional Comprehensive Planning Agencies
- Regional Council of Governments
- Regional Environment Agencies and Commissions
- Regional Water Quality Control Boards
- School Districts
- Waste Management entities

Applicable ordinances of counties, cities and unincorporated jurisdictions where CHSTP facilities are located shall be included in the design as determined by the designer.

6.2 DESIGN REQUIREMENTS BY SUBSYSTEM

Initial CHSTP design criteria will be issued in technical memoranda that provide guidance and procedures for use in advancing the preliminary engineering of the high-speed train facilities. Supplementary guidance for the design of CHSTP facilities are defined in numerous codes, regulations, standards and guidelines. Codes, regulations, design standards and guidelines to be incorporated into CHSTP design as applicable are summarized in Table 6-1. Note that many of the listed documents include additional material for incorporation by reference.

Table 6-1 – Codes, Regulations, Design Standards and Guidelines to Incorporate into Design as Applicable

Sub-Systems	Codes and Regulations	Standards and Guidelines
General	<ul style="list-style-type: none"> Code of Federal Regulations (CFR) 49 Parts 200-299 State of California Board for Professional Engineers and Land Surveyors, Land Surveyors Act (Business & Professional Code 8700-8805) U.S. Environmental Protection Agency (EPA) Laws, Regulations, Guidance and Dockets, and Executive Orders 	<ul style="list-style-type: none"> Manual for Railway Engineering of the American Railway Engineering and Maintenance-of-Way Association (AREMA Manual) Caltrans Highway Design Manual, Chapter 80: Application of Design Standards Caltrans Project Development Procedures Manual
INFRASTRUCTURE		
Alignment (Plan and Profile)	<ul style="list-style-type: none"> Technical Specifications for Interoperability for the Trans-European High-Speed Rail System (TSI) CFR49 Part 213, Track Safety Standards, generally and also in particular Subpart G –Train Operations at Track Classes 6 and Higher. CFR49 Part 214, Railroad Workplace Safety. California Public Utilities Commission (PUC) General Order (GO) 26: Clearances On Railroads And Street Railroads As To Side And Overhead Structures, Parallel Tracks And Crossings CPUC GO 95: Overhead Electric Line Construction. Generally and also see in particular Section VII, Detailed Construction Requirements for Trolley and Electric Railway Contact and Feeder Conductors and Their Supporting Messengers, Span Wires, Etc. (Class T Circuits) CPUC GO 118: Regulations Governing the Construction, Reconstruction, and Maintenance of Walkways Adjacent to Railroad Trackage and the Control of Vegetation Adjacent Thereto CPUC GO 164: Rules And Regulations Governing State Safety Oversight Of Rail Fixed Guideway Systems UIC (International Union of Railways) Code 703 – Layout Characteristics of Lines Used by Fast Passenger Trains 	<ul style="list-style-type: none"> Caltrans Manuals and Standards, including Highway Design Manual and Section VII, Detailed Construction Requirements for Trolley and Electric Railway Contact and Feeder Conductors and Their Supporting Messengers, Span Wires, Etc. (Class T Circuits) AREMA Manual, in particular Chapter 1: Roadway and Ballast , Chapter 5: Track, Chapter 17: High Speed Rail Systems, Chapter 28: Clearances ,Chapter 33: Electrical Energy Utilization Comité Européen de Normalisation – European Committee for Standardization (CEN standard) UIC – Design of new lines for speeds of 300 – 350 km/h Caltrans Surveys Manual Caltrans User's Guide to Photogrammetric Products and Services United States Bureau of Land Management's Manual of Surveying Instructions United States Geological Survey (USGS) National Map Accuracy Standards Manual of Photogrammetry, American Society of Photogrammetry and Remote Sensing Caltrans Plans Preparation Manual, including Caltrans CADD Standards, Caltrans Surveys Manual (Chapter 4, Survey Datums) Caltrans EZ Guide, CADD Users Manual Burlington Northern Santa Fe (BNSF) Railway Engineering Standards Union Pacific (UP) Railroad Engineering Standards Southern California Regional Rail Authority (SCRRA) Engineering Standards Peninsula Corridor Joint Powers Board (Caltrain) Design Criteria and Engineering Standards
Temporary Construction Facilities	<ul style="list-style-type: none"> Applicable codes and regulations to be defined 	<ul style="list-style-type: none"> Applicable standards and guidelines to be defined

Sub-Systems	Codes and Regulations	Standards and Guidelines
Stations	<ul style="list-style-type: none"> • 49 CFR Part 213, Track Safety Standards • 49 CFR Parts 27, 37 and 38, Transportation for Individuals with Disabilities • California Public Utilities Commission (PUC) General Orders (GO), including: <ul style="list-style-type: none"> • GO 26: Clearances On Railroads And Street Railroads As To Side And Overhead Structures, Parallel Tracks And Crossings • GO 164: Rules And Regulations Governing State Safety Oversight Of Rail Fixed Guideway Systems • Technical Specifications for Interoperability for the Trans-European High-Speed Rail System (TSI) • Americans with Disabilities Act (ADA) • ADA Guidelines for Buildings and Facilities (ADAAG) • National Fire Protection Association (NFPA) 130: Standard for Fixed Guideway Transit and Passenger Rail Systems • NFPA 101: Life Safety Code • International Building Code (IBC) • Uniform Building Code (UBC) • California Code of Regulations (CCR), Title 24, California Building Standards Code 	<ul style="list-style-type: none"> • American National Standards Institute (ANSI) 117.1 – standard for accessible design for persons with disabilities • SCRRA Engineering Standards • Caltrain Design Criteria and Engineering Standards • Amtrak Station Program & Planning Standards and Guidelines • California Disabled Accessibility Guidebook (CalDAG) • AREMA Manual, in particular Chapter 4: Rail, Chapter 5: Track, and Portfolio of Trackwork Plans • UP Railroad Engineering Standards • BNSF Railway Engineering Standards

Sub-Systems	Codes and Regulations	Standards and Guidelines
Bridges and Elevated Structures	<ul style="list-style-type: none"> • 49 CFR Part 213, Appendix C - Statement of Agency Policy on the Safety of Railroad Bridges • NFPA Codes and Standards including 130 - Standard for Fixed Guideway Transit and Passenger Rail Systems • California Code of Regulations (CCR) Title 24, California Building Standards Code • American Concrete Institute (ACI) 318, Building Code Requirements for Reinforced Concrete • American Welding Society (AWS), Structural Welding Code, Steel, 1996 ANSI/AWS D1.1-96 and Bridge Welding Code ANSI/AASHTO/AWSD1.5-95 	<ul style="list-style-type: none"> • European Standard EN 1990 annexe A2: Application to Bridges Federal Railroad Administration (FRA) requirements for containment of high-speed trains on aerial structures • AREMA Manual • American Institute of Steel Construction (AISC), Steel Construction Manual • American Association of State Highway and Transportation Officials (AASHTO) Load and Resistance Factor Design (LRFD) Bridge Design Specifications, 2007, with California Amendments • Caltrans Bridge Design Manuals, including: Bridge Design Specification (CBDS), Bridge Design Practices Manual (CBPD), Bridge Design Aids Manual (CBDA), Bridge Design Details Manual (CBDD), Bridge Memo to Designers Manual (CMTD), Standard Specifications, Standard Plans, Seismic Design Memorandum, Caltrans Seismic Design Criteria ver. 1.4 (CSDC)) • European Standard EN 1991-2:2003 Traffic Loads on Bridges • European Standard EN 1990 Annex A2: Application to Bridges • Federal Emergency Management Agency (FEMA) 356 - Prestandard and Commentary for the Seismic Rehabilitation of Buildings • National Earthquake Hazards Reduction Program (NEHRP) – Recommended Provisions for Seismic Regulations for New Buildings and Other Structures • Federal Highway Administration (FHWA) Seismic Retrofitting Manual for Highway Structures: Part 1-Bridges and Part 2-Retaining Structures, Slopes, Tunnels, Culverts, and Roadways • Applied Technology Council (ATC) 32 – Improved Seismic Design Criteria for California Bridges: Provisional Recommendations

Sub-Systems	Codes and Regulations	Standards and Guidelines
Tunnels	<ul style="list-style-type: none"> California Public Utilities Commission (CPUC) General Order (GO) 26: Clearances On Railroads And Street Railroads As To Side And Overhead Structures, Parallel Tracks And Crossings CPUC GO 95: Overhead Electric Line Construction. Generally and also see in particular Section VII, Detailed Construction Requirements for Trolley and Electric Railway Contact and Feeder Conductors and Their Supporting Messengers, Span Wires, Etc. (Class T Circuits) CPUC GO 118: Regulations Governing the Construction, Reconstruction, and Maintenance of Walkways Adjacent to Railroad Trackage and the Control of Vegetation Adjacent Thereto NFPA 130, Standard for Fixed Guideway Transit and Passenger Rail Systems Swiss code SIA 197/1:2004, "Projets de tunnels – Tunnel ferroviaires" Technical Specification for Interoperability (TSI) relating to 'safety in railway tunnels' in the trans-European conventional and high-speed rail system International Union of Railways (UIC) Code 779-11-R and 779-9-R American Concrete Institute (ACI) 318, Building Code Requirements for Reinforced Concrete American Welding Society (AWS): Structural Welding Code, Steel, 1996 ANSI/AWS D1.1-96 and Bridge Welding Code ANSI/AASHTO/AWS D1.5-95 California Code of Regulations (CCR) Title 24, California Building Standards Code 	<ul style="list-style-type: none"> Rete Ferroviaria Italiana (RFI, Italian railway network) Design Handbook, Safety Standards for New Railway Tunnels Comité Européen de Normalisation (CEN), European Committee for Standardization Standard UIC – Design of new lines for speeds of 300 – 350 km/h Société Nationale des Chemins de fer français (SNCF, French National Railway) – High-speed railway design standards (2007 edition) AREMA Manual, in particular Chapter 17: High Speed Rail Systems and Chapter 28: Clearances BNSF Railway Engineering Standards UP Railroad Engineering Standards Southern California Regional Rail Authority (SCRRA) Engineering Standards Caltrain Design Criteria and Engineering Standards Amtrak Design Criteria American Institute of Steel Construction (AISC), Steel Construction Manual American Association of State Highway and Transportation Officials (AASHTO) Load and Resistance Factor Design (LRFD) Bridge Design Specifications, 2007, with California Amendments Caltrans Bridge Design Manuals, including: Bridge Design Specification (CBDS), Bridge Design Practices Manual (CBPD), Bridge Design Aids Manual (CBDA), Bridge Design Details Manual (CBDD), Bridge Memo to Designers Manual (CMTD), Standard Specifications, Standard Plans, Seismic Design Memorandum, Caltrans Seismic Design Criteria ver. 1.4 (CSDC)) European Standard EN 1991-2:2003 Traffic Loads on Bridges European Standard EN 1990 Annex A2: Application to Bridges Federal Emergency Management Agency (FEMA) 356 - Prestandard and Commentary for the Seismic Rehabilitation of Buildings National Earthquake Hazards Reduction Program (NEHRP) – Recommended Provisions for Seismic Regulations for New Buildings and Other Structures Federal Highway Administration (FHWA) Seismic Retrofitting Manual for Highway Structures: Part 1-Bridges and Part 2-Retaining Structures, Slopes, Tunnels, Culverts, and Roadways Applied Technology Council (ATC) 32 – Improved Seismic Design Criteria for California Bridges: Provisional Recommendations

Sub-Systems	Codes and Regulations	Standards and Guidelines
Buildings	<ul style="list-style-type: none"> Americans with Disabilities Act (ADA) ADA Guidelines for Buildings and Facilities (ADAAG) National Fire Protection Association (NFPA) 130 California Code of Regulations (CCR) Title 24, California Building Standards Code California Public Utility Commission (CPUC) General Orders (GO) International Building Code (IBC) Uniform Building Code (UBC) American Concrete Institute (ACI) 318, Building Code Requirements for Reinforced Concrete American Welding Society (AWS) Structural Welding Code, Steel, 1996 ANSI/AWS D1.1-96 and Bridge Welding Code ANSI/AASHTO/AWS D1.5-95 	<ul style="list-style-type: none"> California Disabled Accessibility Guidebook (CalDAG) American Association of State Highway and Transportation Officials (AASHTO) Load and Resistance Factor Design (LRFD) Bridge Design Specifications, 2007, with California Amendments AREMA Manual American Institute of Steel Construction (AISC), Steel Construction Manual Caltrans Bridge Design Manuals, including: Bridge Design Specification (CBDS), Bridge Design Practices Manual (CBPD), Bridge Design Aids Manual (CBDA), Bridge Design Details Manual (CBDD), Bridge Memo to Designers Manual (CMTD), Standard Specifications, Standard Plans, Seismic Design Memorandum, Caltrans Seismic Design Criteria ver. 1.4 (CSDC)) European Standard EN 1991-2:2003 Traffic Loads on Bridges European Standard EN 1990 Annex A2: Application to Bridges Federal Emergency Management Agency (FEMA) 356 - Prestandard and Commentary for the Seismic Rehabilitation of Buildings National Earthquake Hazards Reduction Program (NEHRP) – Recommended Provisions for Seismic Regulations for New Buildings and Other Structures Federal Highway Administration (FHWA) Seismic Retrofitting Manual for Highway Structures: Part 1-Bridges and Part 2-Retaining Structures, Slopes, Tunnels, Culverts, and Roadways Applied Technology Council (ATC) 32 – Improved Seismic Design Criteria for California Bridges: Provisional Recommendations
Grading	<ul style="list-style-type: none"> International Union of Railways (UIC) Code 719 R “Earthworks and Track-bed Layers for Railway Lines” 	<ul style="list-style-type: none"> AREMA Manual Caltrans Highway Design Manual Caltrans Standard Specification International Organization for Standardization (ISO) Comité Européen de Normalisation (CEN. European Standards Committee) U.S. Army Corp of Engineers Technical and Design Guides American Society for Testing and Materials (ASTM) Standards British Standards Institute (BSI) Standards Union Internationale des Chemins de fer (UIC, International Union of Railways)
Hydrology/Hydraulics / Drainage	<ul style="list-style-type: none"> Applicable codes and regulations to be defined 	<ul style="list-style-type: none"> Applicable standards and guidelines to be defined
Utilities	<ul style="list-style-type: none"> CPUC General Orders 	<ul style="list-style-type: none"> Caltrans Highway Design Manual Caltrans Project Development Procedures Manual AREMA Manual

Sub-Systems	Codes and Regulations	Standards and Guidelines
Geotechnical	<ul style="list-style-type: none"> Applicable codes and regulations to be defined 	<ul style="list-style-type: none"> American Society for Testing and Materials (ASTM) Standards per FHWA, Caltrans, and AREMA American Society of Civil Engineers (ASCE), "Geotechnical Baseline Reports for Construction – Suggested Guidelines" FHWA Checklist and Guidelines for Review of Geotechnical Reports and Preliminary Plans and Specifications Caltrans Guidelines for Preparing Geotechnical Design Reports Caltrans Guidelines for Structures Foundations Reports
Right of Way	<ul style="list-style-type: none"> Applicable codes and regulations to be defined 	<ul style="list-style-type: none"> Applicable standards and guidelines to be defined
Construction Cost Estimate	<ul style="list-style-type: none"> Applicable codes and regulations to be defined 	<ul style="list-style-type: none"> Federal Transit Agency - Standard Cost Categories International Association for the Advancement of Cost Engineering (AACE) - Recommended Practice No. 10S-90 – Cost Engineering Terminology
SYSTEMS		
Traction Power	<ul style="list-style-type: none"> CPUC General Orders (GO) including GO95: Overhead electric line construction will require Amendments to cover 2 x 25 kV (or 25kV) National Electrical Code (NEC) National Electrical Safety Code (NESC) NFPA Codes and Standards 	<ul style="list-style-type: none"> AREMA Manual Institute of Electrical and Electronics Engineers (IEEE) 80: Safety in Substation Grounding and other applicable standards
PUC/Electric Power Connections	<ul style="list-style-type: none"> CPUC General Orders (GO) including GO95: Overhead electric line construction will require Amendments to cover 2 x 25 kV (or 25kV) National Electrical Code (NEC) National Electrical Safety Code (NESC) NFPA Codes and Standards 	<ul style="list-style-type: none"> AREMA Manual Institute of Electrical and Electronics Engineers (IEEE) 80: Safety in Substation Grounding and other applicable standards
Overhead Contact System (OCS)	<ul style="list-style-type: none"> Technical Specifications for Interoperability for the Trans-European High-Speed Rail System (TSI) CPUC General Orders (GO) including GO95: Overhead electric line construction will require Amendments to cover 2 x 25 kV (or 25kV) GO26-D: Clearances on railroads and street railroads as to side and overhead structures, parallel tracks and crossings 	<ul style="list-style-type: none"> AREMA Manual Amtrak Design Guidelines Caltrain Design Criteria and Engineering Standards
Communications	<ul style="list-style-type: none"> Applicable codes and regulations to be defined 	<ul style="list-style-type: none"> Applicable standards and guidelines to be defined
Trackside Services	<ul style="list-style-type: none"> Applicable codes and regulations to be defined 	<ul style="list-style-type: none"> Applicable standards and guidelines to be defined

6.3 REQUIREMENT PRECEDENCE AND RESOLUTION OF CONFLICTS

6.3.1 Precedence by Jurisdiction

CHSTP design criteria and standards shall supersede industry standards as they pertain to high-speed train system elements. CHSTP design standards and guidelines may differ from federal and state codes and standards. Regional and local guidance are to be considered but are not mandated. In the case of differing values, the standard followed shall be that which results in the satisfaction of all applicable requirements. Where high-speed trains operate within another railroad or transportation operator's corridor, the requirements of the CHSTP and the owner/operator's standards shall be met.

6.3.2 Precedence by Type of Requirement

In general, applicable regulations and codes take precedence over standards. In the case of differing values between the governing regulations, codes, and standards, the criterion followed shall be that which results in the satisfaction of all applicable requirements. Standards shall be mandated as required for securing regulatory approval.

6.3.3 Resolution of Conflicting Requirements

In the case of conflicts, documentation of the conflicting requirements is to be prepared. The designer shall submit their recommendation for a new design criteria or adoption of one of the conflicting regulations or standards for approval to the Authority. In the case of differing values, conflicts in the various requirements for design, or discrepancies in application of the design standards, the criteria followed shall be that which results in the highest level of satisfaction for all requirements or that is deemed as the most appropriate by the California High-Speed Rail Authority (Authority). The designer shall meet this goal by assessing the appropriate industry standards and proposing project-specific design criteria or use of existing standards in order to meet project objectives and satisfy regulatory requirements.

In cases where the conflict can not be resolved through the use of the common standard or a new project specific design criteria, the Authority shall work with the designer to establish a solution. This may be achieved by preparing a variance request for the conflicting design criteria and securing an approval from the governing regulatory agency. In some cases, this will lead to new regulations, codes, or industry standards.

6.4 PROTOCOLS FOR DESIGN VARIANCE AND EXCEPTION APPROVALS

Variances, or exceptions, to applicable federal and state codes and regulations and design standards require written approval by the agency or authority having jurisdiction.

Technical Memorandum TM 1.1.18 - Design Variance Guidelines defines the procedure for identifying, preparing, requesting, and documenting a design variance from CHSTP Standard Drawings, Standard Specifications, and Minimum Design Criteria as well as other adopted standards or design guidelines.

Application for variance requests, including the preparation of required supporting documentation, is the responsibility of the designer, unless otherwise directed by the Authority.